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BIOLOGICAL STUDIES ON GUNDHI BUG, *LEPTOCORISA ORATORIUS* (FABRICIUS) (HEMIPTERA: ALYDIDAE) UNDER ALLAHABAD, UTTAR PRADESH (UP), INDIA CONDITIONS

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ABSTRACT

This study on the biology of *Leptocorisa oratorius* was carried out in the laboratory so as to understand and chronicle the life-cycle of this notorious insect pest. The number of days between each stage for incubation and nymphal development through to adults was recorded. Each stage was photographed in order to present a pictorial demonstration of the different life stages. It was observed that the incubation period had a range of 3 to 5 days. There were five nymphal stages where the insects molted between each stage. The number of days for each molt was recorded when the same number of exo-skeleton as the number of surviving nymphs present in each culture was observed. The number of days ranged from 3 – 4, 2 – 3, 2 – 4, 2 – 5 and 7 – 8 for 1st, 2nd, 3rd, 4th and 5th nymphal instars, respectively. The shortest period was observed for the 2nd instar (2 to 3 days), while the longest period was recorded for the 5th instar (7 to 8 days). The 1st, 3rd and 4th instars had an average range of about 3 days for each instar. As such, the total nymphal development period ranged from 16 to 22 days with an average of 19.2 ± 2.28 days. Consequently, the total developmental period from egg to adult ranged from 19 – 27 days with an average range of 23.2 ± 2.86 days. Images presented for each growth stage showed eggs were laid singly, in clusters or in a linear fashion, with the latter being the most common, especially under field conditions. The nymphs had green body with outstanding long black legs. Their antennae were brown with visible white bands. The 1st, 2nd and 3rd instar nymphs, especially the 1st instar, appear similar to ant-like creatures. Wing pads, although not very visible to the naked eye, appeared on the 3rd instar nymphs. This became more visible at the 4th and 5th instars but remained under developed. Well developed wings appeared after the final molt from the 5th instar nymph into adults. The adults were brownish-green in color with more brown on the dorsal side, especially the wings. The ventro-lateral dark dots on the abdomen became visible at this stage, which is a key morphological feature for this species as described earlier. Both the nymphs and adults were slender but the adults were slender and robust. The demonstration of all the stages of *L. oratorius* development should make this notorious pest easy to be identified and this knowledge can allow for timely and effective management, thus a reduction in the qualitative and quantitative losses on the yield of rice.

KEYWORDS: Leptocorisa Oratorius, Gundhi Bug, Life-Cycle, Rice

INTRODUCTION

Rice (*Oryza sativa* L.) is the most economically important food crop in many developing countries, and has also

become a major crop in many developed countries where its consumption has increased considerably, particularly in North America and the European Union due to food diversification and immigration (Tran, 1997). However, insect pests are among the most important biological constraints limiting rice yield potential (Litsinger, 2009). Losses due to insects reflect large scale reduction both in quality and quantity. In general, losses due to these pests were reported to be in excess of 30% (Heinrichs, 1994), while unreported cases were as high as 100%. The latter suggests complete destruction of the rice plant, either during the vegetative or reproductive growth stages. The major insect pest of rice in Allahabad, Uttar Pradesh (UP), India is the grain sucking gundhi bug, *Leptocorisa* species. Generally, losses due to this bug may range from 15 – 20% (Nigam and Verma, 1985); however, percent ear head damage was found to range from 68 – 98% in Madhya Pradesh (Bhadauria and Singh, 2009). When the bugs feed during the flowering stage, the grains become sterile, while feeding during the milk stage results in empty or half-filled discolored grains, thus a reduction in quantity. However, feeding during the dough or maturing stage results in 'pecky' grains, thus a reduction in quality (Patel *et al*, 2006).

The management of this deleterious insect pest greatly depends on its proper and timely identification in order to apply appropriate management strategies. All growth stages, especially nymphs and adults, maybe present during the susceptible growth stage of the rice plant. In fact, the bugs are known to hangout and reproduce on certain grasses near or around rice cultivations (Torres *et al*, 2010 and Dale, 1995), which makes it easy for both nymphs and adults to invade the rice crop during the reproductive growth phase. Otherwise, migrating adult bugs into the rice field begin to reproduce, as such, the presence of all life stages of *L. oratorius* maybe observed on the rice plant. As such, the objective was to study the biology of *L. oratorius* and chronicle each growth stage under Allahabad conditions.

MATERIAL AND METHODS

This study on the biology of *Leptocorisa oratorius* was carried out in the laboratory so as to understand and chronicle the life-cycle of this notorious insect pest. Several pairs of gundhi bugs were collected while in copulation and taken to the laboratory. Bugs were placed for egg-laying in conical flasks covered with nylon mesh. Fresh panicles in the milk stage were added to the conical flasks as food for the bugs. Freshly laid eggs on leaves or panicles were removed and placed in petri-plates and observed daily. Nymphs that emerged on the same day were placed in the same petri-plate and provided with fresh panicles in the milk stage. The nymphs were observed daily through the developmental stages, from first instar to adult. Dates for each molt were recorded. Each developmental stage, from egg to adult, was photographed using a digital camera, with or without the help of a stereoscopic microscope. This study was terminated at the time of adult emergence.

RESULTS AND DISCUSSIONS

The duration for each life stage, inclusive of the incubation period and five nymphal instars, is presented in Table 1. It was observed that the incubation period from the time of egg laying to hatching lasted for a range of 3 to 5 days. There were five nymphal stages where the insects molted between each stage. The number of days for each molt was recorded when the same number of exo-skeleton as the number of surviving nymphs present in each culture was observed. The number of days ranged from 3 – 4, 2 – 3, 2 – 4, 2 – 5 and 7 – 8 for 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} nymphal instars, respectively. The shortest period was observed for the 2^{nd} instar (2 to 3 days), while the longest period was recorded for the 5^{th} instar (7 to 8 days). The 1^{st}, 3^{rd} and 4^{th} instars had an average range of about 3 days for each instar. As such, the total nymphal development period ranged from 16 to 22 days with an average of 19.2 ± 2.28 days. Consequently, the total developmental

period from egg to adult ranged from 19 – 27 days with an average range of 23.2 ± 2.86 days. Similar findings were reported by Hosamani *et al* (2009). They found the total nymphal period to range from 15 to 23 days with an average of 18.7 ± 2.08 and total developmental period from egg to adult to range from 21 to 31 days with an average of 25.76 ± 2.73 days. On the contrary, Dale (1995) mentioned that the minimum number of days for the nymphal period is twenty-five. He stated that the nymphs pass through five instars in a period of 25 to 30 days to become adults, which is longer than the maximum limit found in this study and as reported by Hosamani *et al* (2009). However, according to Panizzi *et al* (2000), the incubation period of *L. oratorius* maybe for 5 to 8 days; while the nymphal developmental time maybe for 15 to 32 days.

The variation of these findings can be as a result of several factors beyond human control. For instance, insects are poikilothermic animals that are largely affected by various environmental factors, out of which temperature probably has the greatest effect on insect development (Ju *et al*, 2011). According to Li *et al* (2013), many studies were done to determine the relationship between temperature, development and reproduction of agricultural insect pests. Likewise, Estay *et al* (2009) reported that changes in climatic conditions could profoundly affect the population dynamics as these effects could be direct through the influence that weather may have on the insects' physiology and behavior. As such, the findings of this study should be considered for *L. oratorius* under Allahabad, UP conditions.

A pictorial demonstration of the different developmental stages, from eggs to adults, is presented in Plate 1. Eggs were laid singly, in clusters or in a linear fashion, with the latter being the most common, especially under field conditions. The nymphs had green body with outstanding long black legs. Their antennae were brown with visible white bands. The 1st, 2nd and 3rd instar nymphs, especially the 1st instar, appear similar to ant-like creatures. In fact, the nymphs of all alydines mimic ants in form and behavior (Panizzi *et al*, 2000). Wing pads, although not very visible to the naked eye, appeared on the 3rd instar nymphs. This became more visible at the 4th and 5th instars but remained under developed. Well developed wings appeared after the final molt from the 5th instar nymph into adults. The adults were brownish-green in color with more brown on the dorsal side, especially the wings. The ventro-lateral dark dots on the abdomen became visible at this stage, which is a key morphological feature for this species as described earlier. Both the nymphs and adults were slender but the adults were slender and robust.

CONCLUSIONS

This study revealed that eggs are laid singly, in clusters or in a linear fashion and may take about 4 days to hatch. There were five nymphal stages with a total nymphal development period of about 19.2 days. The total developmental period from egg to adult took about 23.2 days. Nymphs were green in color with outstanding long black legs, while their antennae were brown with visible white bands. The 1st, 2nd and 3rd instar nymphs, especially the 1st instar, appear similar to ant-like creatures. Wing pads, although not very visible to the naked eye, appeared on the 3rd instar nymphs, which became more visible at the 4th and 5th instars but remained under developed. Well developed wings appeared after the final molt from the 5th instar nymph into adults. The adults were brownish-green in color with more brown on the dorsal side, especially the wings, with ventro-lateral dark dots on the abdomen. Both the nymphs and adults were slender but the adults were slender and robust. The demonstration of all the stages of *L. oratorius* development should make this notorious pest easy to be identified and this knowledge can allow for timely and effective management, thus a reduction in the qualitative and quantitative losses on the yield of rice.

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APPENDICES

Table 1: Duration of Life Stages of *Leptocorisa Oratorius* on Rice in the Laboratory

Developmental Stage	Range (Days)	Mean ± SD
Incubation period	3 – 5	4.0 ± 1.0
Nymphal period:		
1st instar	3 – 4	3.0 ± 0.45
2nd instar	2 – 3	2.2 ± 0.45
3rd instar	2 – 4	3.0 ± 0.71
4th instar	2 – 5	3.4 ± 1.34
5th instar	7 – 8	7.4 ± 0.55
Total nymphal period	16 – 22	19.2 ± 2.28
Total developmental period (egg to adult)	19 – 27	23.2 ± 2.86

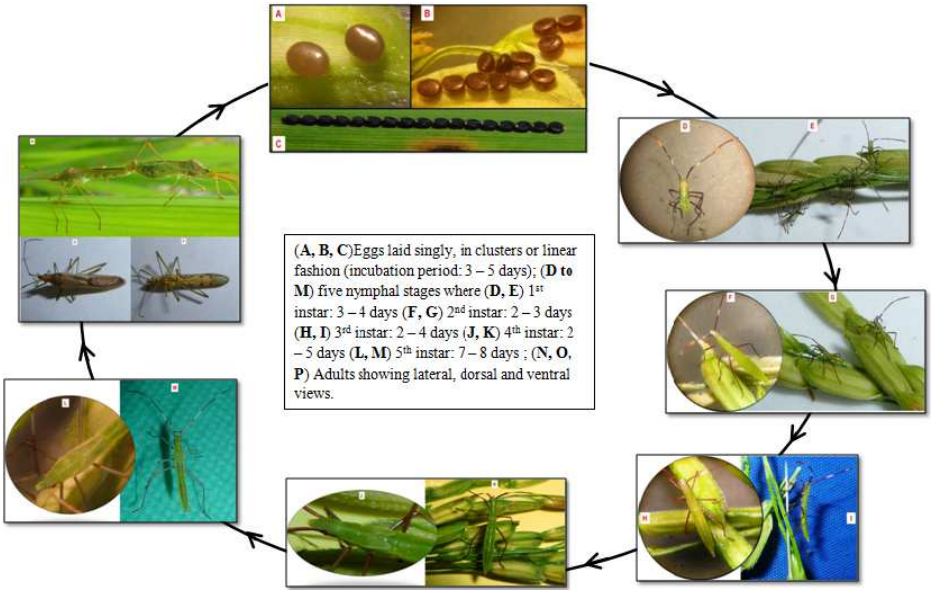

Plate 1: Pictorial Demonstration of *L. Oratorius* Life-Cycle and Duration between Molts Under Allahabad, UP, India Condition